LEAK RESISTANT SIPHONING DEVICE FOR USE IN FLUID TRANSFER

BACKGROUND OF THE INVENTION

The present invention relates to a siphoning and discharge device for use in fluid transfer. An example of such a device is a food baster. Other examples include medicine droppers and pipettes. More specifically the present invention relates to a leak resistant siphoning and discharge device for handling hot fluids, and which employs an elastomeric valve to prevent leakage.

Basters are most commonly used in cooking to transfer hot juices from the bottom of the cooking pan back on to the meat/food being cooked in the pan to keep the meat/food moist while cooking. Commercially there have been few substantial improvements made to these devices due to the low cost nature of the device. But, the low cost basters do not adequately contain the liquid so as to effectively reduce leakage of liquid or partial solids that are drawn into the device for transfer to the desired location.

Basters come in a variety of sizes and shapes. Basters typically consist of a plastic, metal or glass elongated hollow body member and a resilient suction bulb, which is removably attached to the elongated hollow body member. The basters use suction, created by squeezing the resilient bulb, to draw liquid and partial liquids into the elongated hollow body member. It relies on the vacuum being held by the resilient bulb or the user to hold a constant pressure on the resilient bulb. To discharge the liquid and partial solids from the open end of the tube, the bulb is squeezed to increase the pressure of the air above the liquid and partial solids, expelling them.

Liquid and/or partial solids that are drawn up into the hollow member often leak out of the baster unintentionally. Also if the elongated hollow body member is tilted at a sufficient

angle it allows the liquid contents to break the vacuum, across the baster, causing the liquid to leak out of the elongated hollow body member. Leaks can also occur because the heat from the liquids causes the pressure of the air to build up in the bulb and force out some of the liquid or because something inadvertently places pressure on the bulb, such as a weighted object or a person inadvertently putting a hand or leaning on the bulb.

The disadvantage of leaking is that the liquid or partial solids are hot enough to burn users or people and pets that are nearby. The fats often contained in the liquid cause the fluid to burn to a greater extent than other hot liquids would. Also the leaking contents can spill on the floor, the counter, or the stove creating an unsightly mess, or worse, a safety hazard because of slip-and-falls or because the oven's heating element can ignite the liquid creating a fire hazard.

In addition, over time the resilient bulb stiffens and becomes less resilient decreasing its ability to pull a vacuum and to hold liquids and partial solids in the elongated hollow body member. The materials that are used are such that they deteriorate over time. Frequently cracks develop in the bulb, which again affects the ability to create suction in the elongated hollow body member. The deterioration can lead to inadequate sealing, which again causes problems with the baster holding vacuum. The junction between the bulb and the elongated hollow body member also deteriorates over time as the resilient bulb ages, losing elasticity. Many of the commercially available basters can be cleaned in dishwasher, but this can accelerate deterioration by assembling and disassembling the bulb and the elongated hollow body member. Also, the heat of the dishwasher can cause the elastomeric bulb to outgas elastomers and/or plasticizers and lose resilience and the ability to seal with the hollow body.

Further, the prior art basters typically can not be tilted at an angle so as to be effective in easily and efficiently basting foods. The basters which attempt to solve the problems note above present expensive solutions, and are not commercially cost effective. For example, where the basters have a primary valve located at the open tapered end of the tube, they tend to not seal adequately, are difficult to clean, or are complex in design and/or in operation.

The problems with the prior art basters are seen in the prior art patents. For example, U.S. Pat. No. 6,634,393 B2 to Jerry Porter discloses a baster where a primary valve is located at

the outlet of the tube and the valve is a ball to close off the open end of the tube.. This presents sealing problems. The weight of the ball assembly and liquid is the only means for the ball to return to its sealing position. The slippery nature of the liquid being drawn into the tube will tend to prevent the ball from sealing. Porter teaches adding a projection to activate or move the ball to allow liquid to be drawn in, but this also allows the user to "bump" or dislodge it causing an accidental discharge of liquid. Further, the air vent located near the bulb will also act as a means for liquid to run out when the baster is rotated to a horizontal plane. Furthermore the valve that Porter suggests is dependent on gravity to return to its sealing position. Changing the angle and orientation of the baster tube will limit the effectiveness of the sealing.

Porter, US Patent No. 6,634,393, teaches a baster which, in operation, vents air from an upper chamber through a hole placed in the top of the hollow tube. The function of this hole is to allow air to bleed off. Then, upon releasing the bulb a vacuum is created, by the bulb edge covering up the hole, but the vacuum has to be sufficient to overcome the leakage of the vent hole in order to draw the liquid into the tube. This function required the "pumping" action of the bulb due to the volume of the baster being greater than the bulb and the diminished effectiveness of the bulb to create a vacuum due to the vent hole. Due to the nature of an open hole in the top of the tube, the Porter baster does not appear to prevent liquids from coming into contact with the user and causing harm, if the baster is in a horizontal position.

Porter, US Patent No. 5,638,872, discloses a baster which includes a pair of valves where one valve is located at the tip of the tube and second valve is a one way valve. Porter does not claim it to be bi-directional or "open" in nature. This valve by description is automatic in nature. The description of this valve does not require the user to address it in order to make the baster function. The language describes a one-way air valve in the bulb that is intended to exhaust air only. When the bulb is released from its depressed state it creates vacuum. The valves that are described are pictured in the top surface of the bulb and are claimed to prevent liquid from escaping. Even though this feature is claimed there appears to be a lack of enough details to make them function. Porter appears to prefer having a hole in the upper portion of the tube with a rubber band around it to act as a valve.

Kummer, US Patent No. 5,514,118, teaches an medicine dropper which employs a valve between the barrel and the bulb to keep the fluid from filling the barrel further and thus limit the intake to the dosage amount. The valve is a float ball check valve where the ball comes against an annular ridge inside of the barrel to prevent further input into the barrel. Since the ball could not be removed for cleaning, it could be problematic in getting the dropper clean, and would appear to creates another loose part.

Elastomeric valves have found use in preventing leakage in drinking cups for children, where they are employed in the so called "sippy cups". Examples of these valves can be found in, for example, Freeman et al, US Patent No. 5,186,347; Brown, US Patent No. 4,991,745; and Fusco et al, US Patent No. 6,568,557.

SUMMARY OF THE INVENTION

The present invention relates to an improved siphoning device for liquids and/or partial solids, particularly of the type used for basting foods. The present invention offers a low cost means to keep the baster from leaking or splattering hot liquid or partial solids by the means of a check valve assembly just ahead of the bulb end of the liquid tube.

The present invention has three members, an elongated hollow body member, a means for filling or emptying the hollow body member, such as a squeeze bulb to draw fluid up into the elongated hollow body member, and a valve placed between the hollow body and the filling/emptying means. The addition of a valve at the top of the hollow tube before the bulb end, allows a baster to be held in various orientations with less fluid spillage than a prior art baster. The valve can be a valve assembly having two opposing valves which allow air to be expelled outward and also for air to be drawn inward. The use of a bi-directional check valve will mean that a positive pressure is necessary to force the liquid out of the tube. In addition, a vent can be provided so that the vent needs to be closed to draw a vacuum. While this creates an additional operation for the user to perform to use the baster it adds to the safety and reliability of the function.

The check valve assembly located at the top of the tube improves the seal and reduces the volume of air over the column of liquid, increasing the effectiveness of the baster to hold the liquid without leaking. By making the check valve assembly out of a single elastomeric element, it offers an economical solution to the current prior art.

The addition of a vented bulb that can be selectively open or closed by the user offers additional performance benefits of allowing the air that is being heated by the hot fluid to be released. This neutralizes the positive pressure that is created in the bulb that would cause the liquid to be discharged. The bulb has an opening that is molded as part of the design that directs the heated air away from the user.

Less spillage keeps the kitchen area cleaner and safer. The leak resistant baster reduces the opportunity for liquid to be accidentally spilled on the heating elements of the oven reducing the chance of smoke and fire and the need for cleaning.

The device potentially reduces the amount of time to baste because the oven shelf does not have to be extended out in order to baste the food because the baster can be operated at greater angles. The food requires less movement in order to be basted. The oven door can be open for less time therefore saving energy costs and reduces cooking time.

The baster components can be cleaned in a dishwasher. Even as the bulb wears, and the seal between the bulb and the elongated hollow body member becomes less effective the check valve assembly maintains the sealing properties and allows the baster to hold suction more effectively, thereby increasing the safety and useful life of the baster.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described by the way of a non-limiting example, with reference to the attached drawings in which:

FIG. 1 is side view partially in cross section of a baster,

FIG. 2 is an enlarged cross section view of the check valve assembly with two elastomeric valves of the baster in FIG. 1;

FIG. 3 is an enlarged cross section of an alternate embodiment of the check valve assembly utilizing two elastomeric reed valves;

FIG. 4 is a side elevation view of an alternate embodiment of the hollow tube member;

FIG. 5 is an side elevation view of an alternate embodiment of the hollow tube member;

FIG. 6 is a cross sectional view of an alternate embodiment of the check valve assembly using two ball valves;

FIG. 7 is a cross sectional view of an alternate embodiment of the check valve assembly using a single disk check valve;

FIG. 8 is a cross sectional view of an alternate embodiment of the check valve assembly using a two directional single elastomeric valve;

FIG. 9 is a cross sectional view of the check valve assembly shown in FIG. 8 actuated to release the liquid from the baster;

FIG. 10 is a cross sectional view of the check valve assembly shown in FIG. 8 actuated to draw fluid into the baster;

FIG. 11 is a perspective view of an elastomeric valve in accordance with the present invention;

FIG. 12 is a cross-sectional view of the valve shown in Figure 11;

FIG. 13 is a perspective view of a baster in accordance with the present invention and showing an air vent and means for closing the air vent; and

FIG. 14 is a partial cross-sectional view of a baster in accordance with the present invention and showing additional embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention has all the advantages of a prior art baster with several additional advantages. This invention draws on the principals of a vacuum and the addition of a valve at the top of the baster tube between the vacuum source and the tube to create a leak proof device that is simpler to operate, more dependable and as easy to clean than the prior art that is commercially available.

One configuration of the present invention is illustrated in FIG 1. The present invention, as represented via the example of a baster, consists of a resilient bulb 10 and a hollow elongated tube 14. Stretching the open end of the bulb 10 over the end of the tube 14 easily assembles these parts. Circumferential projections 16 are added to the elongated tube 14 to increase the sealing properties between the bulb 10 and the tube 14.

Although the invention is illustrated as a baster, it should be appreciated that the present invention could be applied to any device used for fluid transfer such as a medicine dropper, an eye dropper, a pipette, a liquid/liquid or liquid/solid separator, or the like. Further, although the device is illustrated using a resilient bulb as the means for filling and discharging or emptying the tube, other means could be employed. For example, the means for filling/emptying could be a piston device which by a linear motion, in one direction, expels air from the tube and in a reverse linear motion draws liquid into the tube. Examples of these type devices are shown in US Patent Nos. 5,408,919 and 6,457,400 to Hutzler et al., the disclosures of which are incorporated herein by reference.

The addition of a valve, such as the check valve assembly 12 shown in Figure 1, between the tube 14 and the bulb 10, has several beneficial advantages. It reduces the dependency of the device on the leak proof fit between the bulb 10 and the tube 14. It also adds the ability to control the vacuum, which allows the liquid column in the tube 14 to be held. Any changes in pressure will increase or decrease the vacuum holding the liquid. Any increase in pressure will allow the baster 30 to expel hot liquid. By employing the check valve assembly 12 it is possible to control the vacuum with no additional effort.

The check valve assembly 12 consists of an elastomeric material that is molded as a one piece assembly It is possible to construct this assembly 12 with two opposing check valves 17 and 18. This allows the size of the check valves 17 and 18 to be optimized for the amount of pressure required to make them open. The elastomeric materials are not critical as long as they provide the requisite strength, flexibility and sealing properties when in a neutral position. Examples of materials that could be employed include silicones, urethanes, and elastomeric polymer and rubber compositions.

The operation of the baster 30 is as follows: Pressure is applied to bulb 10. Air is expelled through the first valve 17 of check valve assembly 12 out through hollow tube 14 and exiting through open end of tube 19. While maintaining pressure on the bulb 10 the open end of the tube 19 is placed into liquid. User gradually releases pressure on bulb 10. As pressure is being released, a vacuum is created at the check valve assembly 12 opening valve 18 creating suction at the open end 19 of the hollow tube 14 where the liquid is drawn into the tube 14. After the desired amount of liquid is extracted or the tube 14 is filled, the baster open end 19 is removed from the liquid.

While the liquid is contained in the baster 30 it is now possible to remove any residual pressure from the bulb 10 and have the liquid remain in tube 14 without leakage. The additional air that is drawn into the bulb 10 is drawn past the liquid and through the check valve 18. The check valves operate automatically from a closed to open back to close orientation in a manner that the vacuum holding the column of liquid is maintained.

For the liquid to be emptied from the tube 14 pressure is applied to the bulb 10. As the pressure increases at the check valve assembly 12, the air will open check valve 17 expelling the liquid out the open end of the tube 19.

FIG. 2 shows an enlarged cross section of an elastomeric check valve assembly 12 with the first valve 18 and second valve 17. The first valve 18 has a first opening 15 for air flow. The second valve 17 has a second opening 19 for air flow. The first valve 18 and second valve 17 have chamfered edges 13 to bias their opening under pressure differentials. As noted, the material used can be silicone or urethane but is not limited to these materials.

As seen in FIG. 3 the check valve assembly 50 can be made using reed valves 32 and 34. The reed valves are attached to the valve assembly 38 using a common type fastener 36 such as a rivet. The materials used can be composite or metal but are not limited to these materials.

The elongated hollow tube can be made in various configurations such as those shown in FIG. 4 and FIG. 5, tubes 60 and 70 respectively. The materials used can be metal or composite but is not limited to these materials

Again the check valve assembly 80 shown in FIG. 6 can be made using a first spring 43 first ball valve 42 and an opposing second spring 41 second ball valve 44. First ball valve 42 and second ball valve 44 actuate when the pressure pushes the ball against the spring, 43 and 41, respectively allowing flow through opening 48 or 46 respectively.

In the simplest form it is possible with this design to utilize one check valve 100 that has bi-directional properties FIG. 8. In this version, with a single check valve 100, it is possible for the check valve to perform its function in both directions. Due to the nature and geometry of the elastomeric material it is possible to have the sealing properties on the cut faces 86 and 88 of a slit 92 that is perpendicular to the plane of material of the valve 94. By having this geometry symmetrical to the plane of the valve 94 it allows the valve 100 to open in either direction when pressure or vacuum is applied to a surface of the valve 100. It is also possible to alter the geometry to improve performance in one direction of operation. It is also able to construct a more complex geometry where the planes of the valve are no longer perpendicular or the surfaces are no longer flat.

FIG. 9 and FIG. 10 show the elastomeric valve 100 shown in FIG. 8 opening in both directions, 110 and 120 respectively. Such valves are known and have been referred to as valves having a "trampoline-like" construction since they take advantage of the natural resiliency of the elastomeric materials to move under pressure, but return to their original shape once the pressure is released. In their rest position, the valve is in a closed, sealed position and prevents the passage of fluids from one side to the other of the valve.

Figures 11 and 12 show yet another embodiment of a resilient valve assembly that can be employed in the present invention. Valve 130 can be made as a one piece valve from an

elastomeric material such a castable or injectable silicone rubber, polyurethane, elastomeric rubber or copolymer, or the like. The valve 130 has a generally cylindrical shape with an outer wall 132 which sealingly engages the inner wall of the tube 14 to hold the valve in place. An annular rim 134 which is integral with wall 132 will engage the top of the tube to prevent the valve from being pushed further into the tube. The valve will consist of two hemicylindrical chambers 136 and 138 which allow the fluids to pass one way through one of the chambers and the other way through the other chamber. At the end of each chamber is an integral wall (140 in chamber 136 and 142 in chamber 138) which otherwise seals of the chamber and functions as a valve. The walls 140 and 142 have slits 141 and 143 in them so that when pressure is applied to the wall the movement will cause the valve to open. The other end of each chamber is open and in communication with the direction from which the fluid is coming. As shown in Figure 14, chamber 136 is in open fluid communication with tube 14, while chamber 138 is in open fluid communication with bulb 210. The configuration of the chambers is such that pressure will build on the chamber side of the valve and open that valve, but not open the other valve. For example, when bulb 210 is compressed in a way which put pressure on valve 130, air is preferentially forced into chamber 138 rather than against wall 140 and as a result the fluid is passes through slit 143 in wall 142. When bulb 210 is used to create a vacuum, the pressure builds in chamber 136 and the flow through the valve is reversed.

Integral with valve 130 is a means from removing the valve, as represented by protuberance 146. This provides a means for grabbing the valve and pull it out of tube 14 when I needs to be cleaned or replaced. The shape is shown a semicircular, but that is not critical and could be rectangular, triangular, or any appropriate geometric shape.

Further, as can be appreciated, valve 130 could be constructed without ridge or rim 134 so that valve 130 is held in place inside tube 14 by forcing the valve in and relying on the resilience of the elastomeric character of the materials of construction. Alternatively, although not shown, valve 130 could be placed into the bulb, either as a separate item or as an integral part of the bulb. In either case, the valve is between the tube and the bulb. Also, the valve could be provided with another protuberance similar to protuberance 146, except located at the distal end of the valve from that shown in Fig. 12. If the valve is place into the bulb, then either protuberance could be used as a grip to remove the valve. If the valve is made with no rim and

two protuberances, then it would be symmetrical in shape, which could simplify manufacture and orientation upon installation.

The resilient bulb can also be molded with a vent hole in such a manner to allow the user to close off the vent hole before the bulb can create pressure or vacuum. In this manner by restricting air out of the vent hole, allows air to be expelled through the tube. If the bulb is being released while the hole is restricted air will be drawn. The vent hole can be positioned in an ergonomic place that allows it to be easily depressed as the bulb is being squeezed or released. The venting hole can be positioned in the bulb to direct the heated air away from the operator as it is being used. The bulb can include a composition, such as Santoprene elastomer, molded into the bulb to provide a better griping surface and can be done in an ergonomic design to allow more efficient and comfortable use.

As can be seen in Figures 13 and 14, vent hole 170 is positioned as an opening in bulb 210 where a passage 172 connects the opening with the interior 174 of bulb 210. This allows air, such as hot gases, to pass out of bulb 210 rather than build up inside it. When it is desired to expel air from bulb 210 and out tube 14, passage 172 can be closed by applying finger pressure to collapse passage 172 since the passage is made from the same resilient material as bulb 210. For convenience, a button or protuberance 176 which is integral with the surface of the bulb can be provided to facilitate the application of pressure to close off passage 172. As illustrated in Figure 14, the use of a button or other shape is optional and the geometry is not critical.

Figure 14 also illustrates the use of a flat weighted portion 180 integral with bulb 210 so that when the baster is on its side, the baster will tend to remain at that spot rather than be free to roll about. The shape and amount of weighting are not critical and need not be in one spot. But, when the weighted portion is opposite the vent 170, the vent is not covered by the weight of the baster. Figure 14 further illustrates the use of grooves and ridges to attach the bulb to the tube. As shown, the portion 182 of bulb 210 which is used to attach it to tube 14 can be provided with annular grooves 186 which will mate with annular ridges or protuberances 184 on end 188 of tube 14. In this way, when bulb 210 is attached to tube 14, the user is assured that the bulb is in

place when the ridges 184 mate with the grooves 186. Although, this feature is not critical to the invention and it is possible to use only ridges without the grooves. Still further, the same could be applied to the inside surface of the tube where annular ridges are provided and these can be designed to mate with groves in the side wall 132 of valve 130. Alternatively, the annular ridge(s) or protuberance(s) could be part of the side wall of the valve and the groove(s) could be provided on the inside of the tube. In either case, these features provide a more secure fit by the bulb on the tube.

As can be seen with the present invention, the air vent in the bulb is protected by the "outside flap" of the bulb and is clearly visible making the present device safer to the end user. The present invention is designed such that it can be taken apart and put in the dishwasher as separate pieces for cleaning. Further, the present invention can be placed on a rack that holds the baster vertically for an "extended" time to separate immiscible liquids or liquid and solids were the solids are lighter than liquids, such as the fats from the fluid. The baster of the present invention can be turned almost horizontal and not leak. The baster of the present invention can have a tube with a curved end to make it easier to draw fluid from a pan and allow the baster to be held in almost a horizontal position while the curved end would be almost vertical. This allows the food to be basted without pulling the rack out of the oven. The baster of the present invention allows the fluid to be "squirted" at the basted food, and would most allow larger solids to be drawn up in the tube. By allowing the tube and tip of the present invention to be a larger diameter than a typical baster, since the size is not critical, the present invention would be useful with aquariums to transfer fish since it does not have a lower valve would most likely injure the fish. In such a circumstance, the end of the tube could have a flared opening to direct the fish into the tube as water is being drawn into the tube.

Various modifications and alterations that do not depart from the scope and spirit of this invention will become apparent to those skilled in the art. This invention is not to be duly limited to the illustrative embodiments set forth herein.